DELCO-REMY

American Motors (4 Cylinder)
General Motors (Exc. Chevette Diesel)

DESCRIPTION

Five types or sizes of 12-volt starting motors are used, all equipped with enclosed solenoid, shift lever, and overrunning clutch mechanisms. Starting motor circuits differ depending upon load and speed requirements.

The 5MT series starting motor differs from the 10MT series in that the 5MT has its field coils permanently mounted in the frame. The 5MT and 10MT starting motors are used on gasoline engines. The 15MT/GR gear reduction starting motor is used on all V6 diesel engines. The 25MT and 27MT starting motors are used on all V8 diesel engines. The 25MT and 27MT starters have a longer shaft and a center bearing to support the longer shaft.

OPERATION

In the basic starting circuit, the solenoid windings are energized when the switch is closed. This causes the plunger and shift lever to move the drive pinion into the flywheel ring gear. The solenoid main contact closes, causing cranking to occur. When the engine starts, pinion overrun prevents armature damage due to excessive speed until the switch is opened. This permits the return spring to disengage the pinion from the flywheel.

TESTING

SOLENOID WINDINGS TEST

NOTE – *Tests are performed on solenoid with all leads disconnected to prevent overheating. Complete tests in a minimum of time to prevent further overheating.*

Hold-In Winding – 1) Connect ammeter in a series with 12-volt battery and the switch terminal on solenoid. See *Fig. 1*. Connect voltmeter between switch terminal and ground. Connect carbon pile across battery.

2) Adjust voltage to 10 volts and note ammeter reading. It should be 14.5-16.5 amps. for all starters.

Pull-In & Hold-In Windings – To check both windings, connect test equipment as shown in *Fig. 1*. Ground "MOT" or "M" (motor) terminal of solenoid. Adjust voltage to 10 volts and note ammeter reading. It should be 41-47 amperes for all starter solenoids.

Test Results – Current draw readings that are above specifications, indicate shorted turns or a ground in windings of solenoid. Solenoid must be replaced. Low current draw readings indicate excessive resistance. No readings indicate an open circuit. Check connections and if OK, replace solenoid.

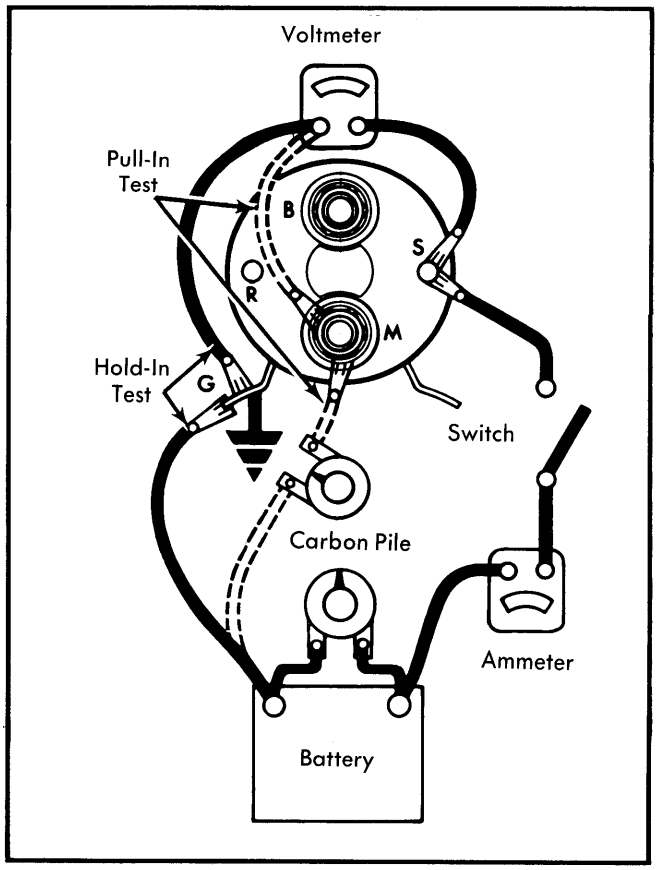

Fig. 1 Solenoid Winding Test Connections

STARTER NO LOAD TEST

NOTE – *Make all connections and disconnections of equipment with switch in open position.*

1) To perform test, connect test equipment to starter as shown in *Fig. 2*. Close switch and compare RPM, amperage, and voltage readings with specifications. See chart.

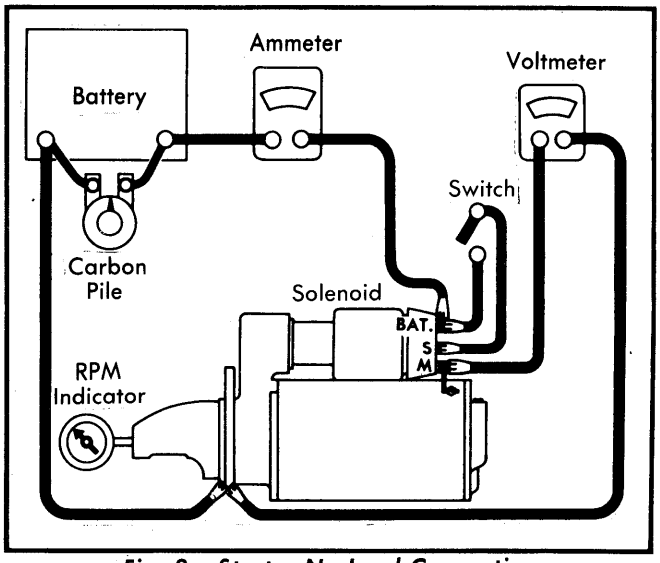

Fig. 2 Starter No Load Connections

DELCO-REMY (Cont.)

CAUTION – *Do not apply voltage greater than specified; excessive voltage may cause armature to throw windings because of excessive speed.*

DELCO-REMY STARTER SPECIFICATIONS

Delco-Remy Number	No Load Test		
	Amps. ①	RPM	Volts
1109495	120-210	9,000-13,400	11
1109526	45-70	7,000-11,900	9
1109530	85	6,800-10,300	9
1109533	45-70	7,000-11,900	9
1109534	45-70	7,000-11,900	9
1109535	45-70	7,000-11,900	9
1109537	57-82	6,000-12,000	9
1109544	45-70	7,000-11,900	9
1998234	65-95	7,500-10,500	9
1998236	60-85	6,800-10,300	9
1998237	65-95	7,500-10,500	9
1998241	70-110	6,500-10,700	9
1998553	160-220	4,000-5,500	9
22515863	125-170	3,200-4,100	9

① – Includes solenoid.

2) If current draw and RPM is to specification, condition of starter motor is normal. If test indicates low free speed and high current draw, problem could be too much friction resulting from tight, dirty or worn bearings; shorted armature; or grounded armature or fields.

3) Failure to operate with high current draw indicates a direct ground in the terminal or fields or frozen bearings. Failure to operate with no current draw indicates an open field circuit, open armature coils or broken brush springs.

4) Low no load RPM and low current draw indicates high internal resistance due to poor connections, defective leads, dirty commutator. High free speed and high current draw indicates shorted fields.

OVERHAUL

DISASSEMBLY

1) Remove screw from field coil connector and solenoid mounting screws. Rotate solenoid 90° and remove, along with plunger return spring. Remove through bolts, commutator end frame (diesel only, remove insulator) and washer.

2) Remove field frame assembly from drive gear housing. (On diesel starter, armature remains in drive end frame.)

3) On V8 diesel models, remove shift lever bolt from drive gear housing. Remove center bearing screws. Remove drive gear housing from armature shaft. Shift lever and plunger will fall away from starter clutch.

4) Remove plunger and shift lever assembly and armature assembly with overrunning clutch from drive end housing.

5) Remove thrust washer or collar from armature shaft. Slide a 5/8" deep socket over shaft against retainer as a driving tool. Tap tool to move retainer off snap ring. Remove snap ring from groove in shaft. If snap ring is distorted, it must be replaced upon assembly.

6) Remove retainer, clutch assembly, assist spring and retainer from armature shaft. (On diesel only, remove fiber washer and center bearing.)

7) Shift lever and plunger may be disassembled by removing the roll pin.

CLEANING

Clean all parts by wiping with clean cloths. Do not clean armature, field coils, or drive assembly in any type of grease dissolving solvent (will damage insulation and wash lubricant out of drive assembly).

COMPONENT TESTING

NOTE – *The following tests are made following starter removal or partial disassembly of the starter.*

Armature – **1)** Test armature for shorted coils with a growler. Check for grounded coils with a 110 volt test lamp. Place one test lead on armature core or shaft, and other test lead on commutator. Lamp should not light. If lamp lights, armature is grounded and should be replaced.

2) Inspect commutator. If commutator is rough, worn or has protruding insulation, turn down commutator in a lathe. Do not turn to less than 1.650". Sand commutator lightly with commutator paper and clean out slots carefully.

CAUTION – *Some starters have molded type commutator and insulation must not be undercut on these models (may cause serious damage to commutator).*

Series Coil Open Test – Using a test lamp, place one lead on series coil terminal and other lead on insulated brush. If lamp fails to light, series coil is open and requires repair or replacement. Repeat test for each insulated brush to check brush and lead continuity.

Series Coil Ground Test – Be sure series coil terminal and shunt coil terminal (if equipped) are separated and not touching a ground during testing. Using a test lamp, place one lead on grounded brush holder and other lead on either insulated brush. If lamp lights, a grounded series coil is indicated which must be repaired or replaced.

Brushes, Springs, & Holders – Replace brushes if worn to one-half original length, or if oil-soaked or pitted. Check brush spring tension and replace springs if weak or distorted. Deformed or bent brush holders can be replaced by service units which are installed with screws and nuts.

PINION CLEARANCE CHECK

Connect 12-volt battery leads to solenoid "S" switch and to ground. Flash a jumper lead from "MOT" or "M" terminal to

DELCO-REMY (Cont.)

starter frame, shifting pinion into cranking position until battery is disconnected. Push pinion away from stop retainer as far as possible. Using feeler gauge, check for .010-.140" clearance between pinion and retainer. *See Fig. 3.*

NOTE – *Pinion clearance is not adjustable. If clearance is not within specifications, motor must be disassembled and checked for defects.*

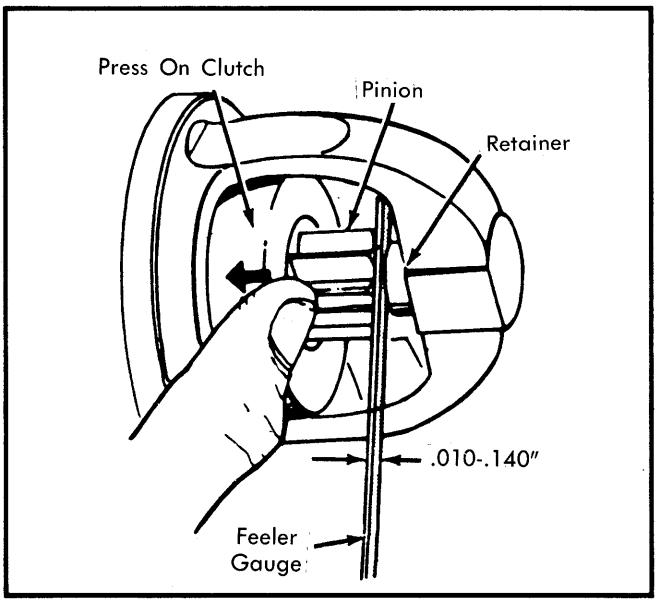

Fig. 3 Checking Pinion End Play

Overrunning Clutch – Clutch pinion should turn freely in one direction only. Check pinion teeth for chipped, cracked or excessive wear. Chipped teeth may indicate a defective ring gear. Test overrunning clutch for slipping while still attached to armature. Wrap armature with a shop towel and clamp in suitable vise. With a $^{15}/_{16}$" 12 point deep socket and torque wrench, clutch should not slip up to 50 ft. lbs. If it slips, replace clutch.

Armature Shaft Bushings (Exc. 15MT/GR) – Inspect armature shaft bearing surfaces and check for wear by noting side play with shaft inserted in bushings. Drive end housing can be replaced. Replace commutator end plate assembly if bushing is worn.

Armature Shaft Bushings (15MT/GR) – Using a tube or solid cylinder that just fits inside housing, push bearing out toward armature side. Press bearing into housing from opposite side until flush with housing.

REASSEMBLY

1) Lubricate drive end of armature shaft with silicone lubricant. Install center bearing (diesel only) with bearing toward armature winding. Install fiber washer on armature shaft.

2) Slide clutch assembly onto armature shaft with pinion away from armature. Slide retainer onto shaft with cupped side facing shaft end. Install snap ring into groove on shaft. Install thrust washer.

3) Position retainer and thrust washer with snap ring in between. Using two pliers, grip retainer and thrust washer and squeeze until snap ring is forced into retainer and is held securely in armature shaft groove.

4) Lubricate drive gear housing bushing. Engage shift lever yoke with clutch and slide complete assembly into drive gear housing. On non-diesel models, the shift lever may be installed in gear housing first. Install center bearing screws (diesel only) and the shift lever pivot bolt. Tighten bolt and install solenoid assembly on drive gear housing.

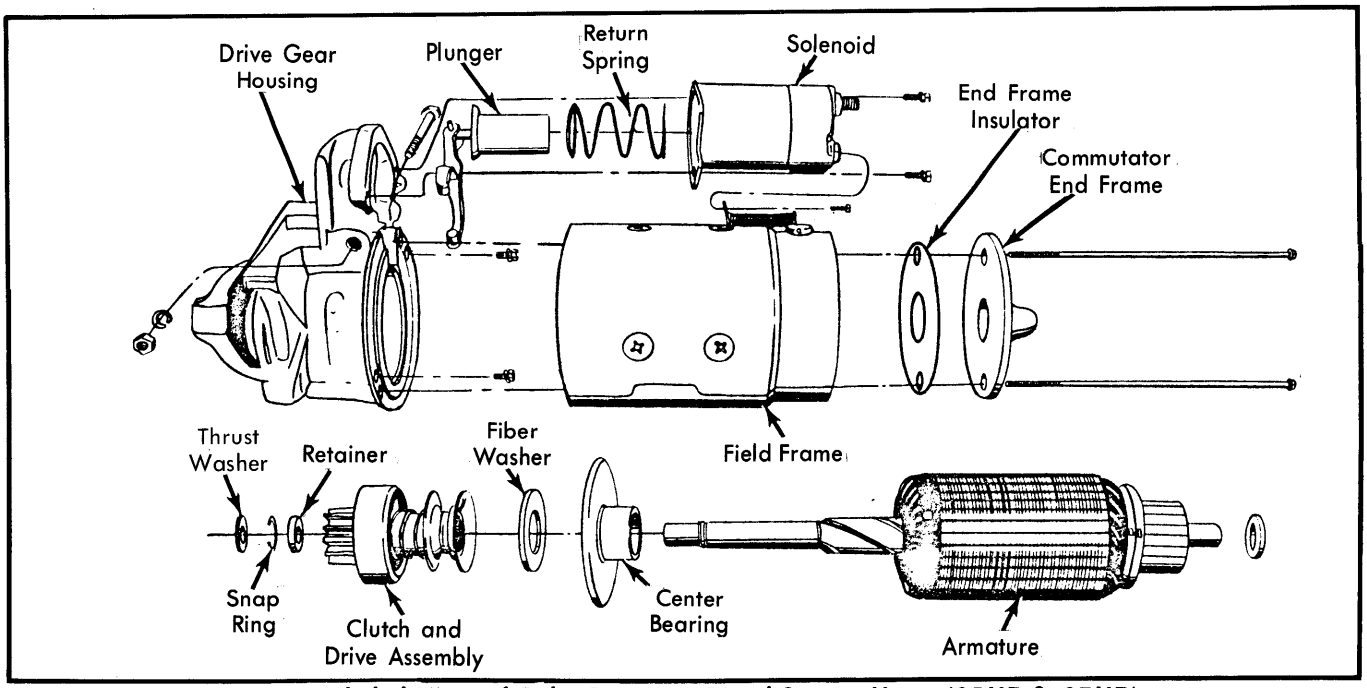

Fig. 4 Exploded View of Delco-Remy V8 Diesel Starter Motor (25MT & 27MT)

DELCO-REMY (Cont.)

5) Apply sealer (1050026 or equivalent) to solenoid flange where field frame contacts it. Position field frame against drive gear housing on alignment pin, being careful not to damage brushes. Lubricate commutator end frame bushing with lubricant (1960954 or equivalent).

6) Install washer on armature shaft and slide end frame onto shaft. On diesel starters, install insulator and then end frame onto shaft. Install through bolts and tighten. Connect field coil connector to solenoid terminal. Make sure through bolts pass through bolt holes in insulator. Check pinion clearance.

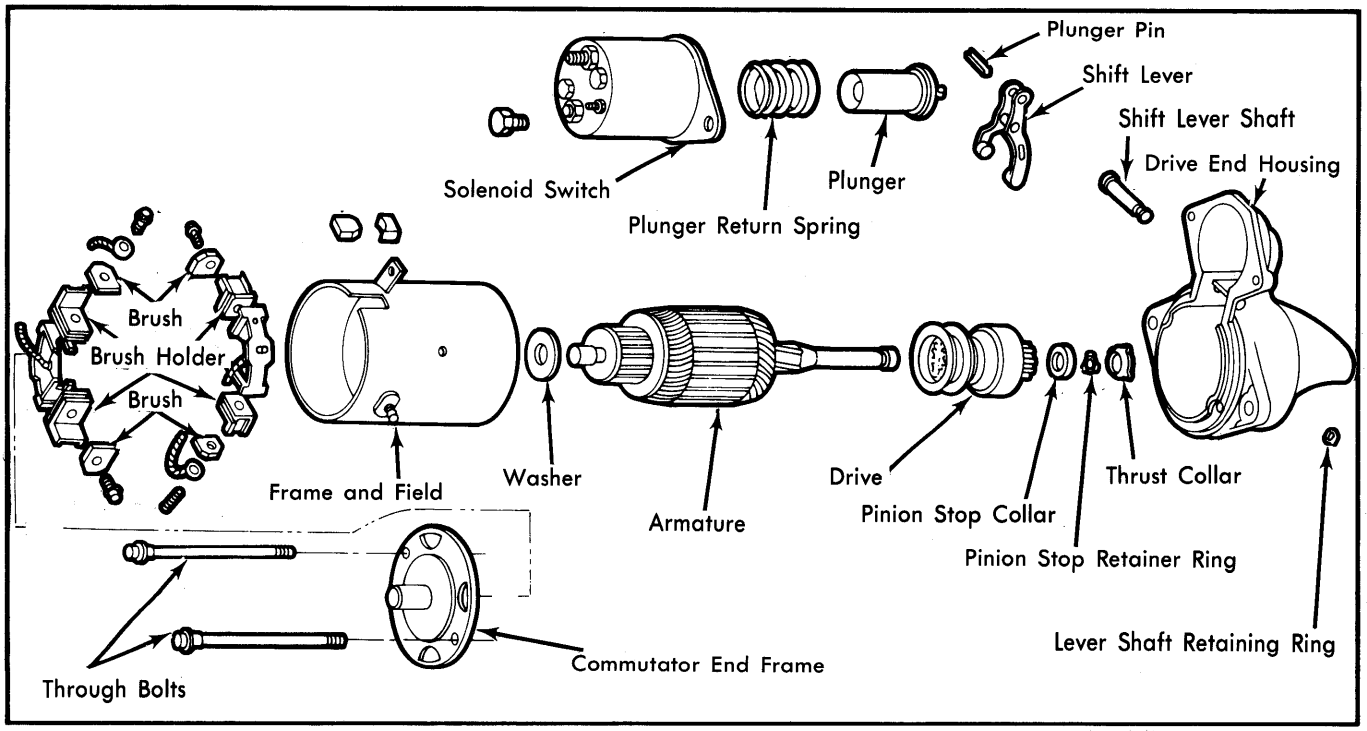

Fig. 5 Exploded View of Delco-Remy 5MT Starter Motor Assembly (10MT Similar)

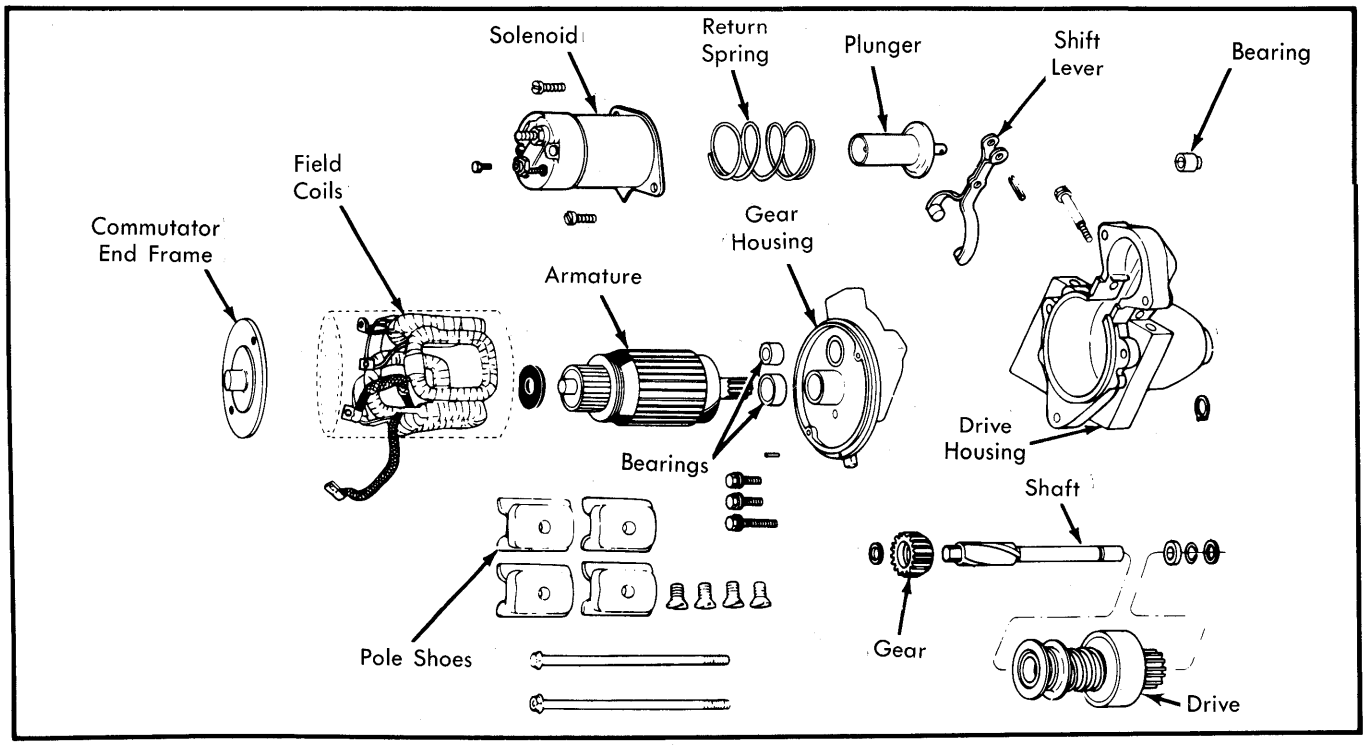

Fig. 6 Exploded View of Delco-Remy V6 Diesel Starter Motor (15MT/GR)